

**Resolved: On balance, the benefits of genetically modified foods outweigh the harms.**

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The public debate over agricultural always has something of an elevated significance in the US - possibly because of how we like to view family farms with nostalgia, but more likely because of the importance of the Iowa caucuses to anyone that wants to run for the White House. More recently this debate has become increasingly complicated as the science of agriculture has expanded and genetically modified foods have become more common-place. While GMO foods have much to offer us, they also carry some sizable risks (though not the risks we often think of). This topic analysis will present some background on the topic, then analyze the resolution itself, before finally discussing some arguments debaters should prepare for on each side.

## **Background**

### What is a GMO?

As with most science topics its important to get an understanding of what's actually going on behind the acronyms and jargon. GMO stands for "Genetically Modified Organism." Sometimes these foods are referred to as "GE" foods (Genetically Engineered), for our purposes both terms are interchangeable. The process of genetic modification usually involves taking genes from one organism and inserting them into the DNA of another. Getting that to work properly takes a lot of time and effort, however, so nearly all GMOs are the products of extensive research and

development. Generally genetic modification is done to take a desirable trait from one organism and integrate it into another. For example, if one plant resists drought extremely well, and bounces back quickly when watered, genetic engineers may attempt to take some of the genes that enable that to happen and transplant them into another kind of plant that doesn't usually handle drought well. If the process works you'll have a version of the plant that can survive in areas it wouldn't normally be able to, and is less likely to get wiped out by drought. At present GMO plants are the main areas of focus, there is not a significant amount of genetically modified livestock being raised (though GMO salmon referred to as "AquaAdvantage Salmon" are currently under review by the FDA, and may be approved before this topic goes live)<sup>1</sup>.

### Common types of GMOs

Two of the most common types of GMOs are ones that are designed to make it easier for farmers to deal with weeds and pests (plant-eating insects and such) that normally are a problem for them. The first type is often referred to as "Roundup Ready," because it has been designed to be resistant to the herbicide Roundup. Roundup is the trade name used for a Glyphosate-based herbicide produced by a company called Monsanto. Glyphosate is quite effective at killing large number of weeds, but its toxic enough that - unless it's carefully applied - it will also kill the crops farmers are trying to protect from the weeds. What Roundup Ready versions of those crops do is allow farmers to spray glyphosate across their entire field without the risk of killing their own crops. Herbicides are very important to effective agriculture, as weeds can choke out and kill many of the crops farmers are trying to grow. The introduction of Roundup Ready crops in the 1990's

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<http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/GeneticEngineering/GeneticallyEngineeredAnimals/ucm280853.htm>

(particularly corn) has made it much more efficient for farmers to deal with troublesome weeds.

This has also created some other complications we'll discuss toward the end.

The second most common type of GMO crops are what are called "Bt crops." Bt crops have been genetically modified through the insertion of a gene from the bacteria *Bacillus thuringiensis*. This gene causes the plant to produce a protein that kills certain pests that attempt to consume it, while having no impact on humans or livestock. This decreases the amount of pesticide that farmers need to spray on their crops in order to eliminate these pests and preserve their harvest. There are complications that stem from this as well, primarily involving the emergence of pests that are resistant to Bt, but those will also be discussed in detail later.

### Development and Patenting

Because it takes a lot of time and research to develop new GMOs the companies that produce them need some way to insure that they make money off the GMO they've developed. It really isn't good for your business if you spend millions of dollars to develop something new, and then after you sell your first batch of products everyone can copy them for free. This is an even bigger deal with GMO plants, since the plants produce seeds which could theoretically be replanted, meaning that companies would only ever be able to sell a single years worth of seeds to anyone, and there's no way they'd be able to make back enough money to cover their research costs then. For this reason, we often permit companies to patent the GMOs they produce and prohibit farmers from re-planting the seeds those plants produce, instead requiring them to buy new seeds each year. This leads to some messy legal issues at times, and there are some ethical arguments to be made about the concept of patenting a living thing. However, without this system it would be difficult - if not impossible - for companies to fund research into new GMOs, making it very unlikely they could ever be

produced. This status may change in the future as the Supreme Court continues to review the patenting of genes, though its unlikely to change massively in the near future<sup>2</sup>.

### Regulation of GMOs

GMOs are regulated to different degrees in different parts of the world. Generally the US is more permissive of GMO foods and Europe is more restrictive<sup>3</sup>. While a few states in the US require products with GMO components to be labeled in some way, most do not. Europe and a number of countries in Asia do require labeling of GMO food and this has complicated sale of food from the US to other parts of the world<sup>4</sup>. In the US the FDA adopts a “substantial equivalence” standard when assessing new GMOs for safety.<sup>5</sup> The GMO must be as safe for human consumption as the unmodified version to be approved. While there is some limited concern that GMOs may contain unexpected allergens, the broad scientific consensus is that they are safe for human consumption<sup>6,7</sup>.

### **Resolutional Analysis**

This resolution is quite straightforward and requires little in the way of definition. However that is not to say that the debate is uncomplicated - discussion about causal relationships and the degree to which GMO foods can be blamed for some to the problems that surround their use may take some rounds in a more theoretical direction. In many ways, the version of this debate that plays

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2 <http://www.nature.com/news/biotech-reels-over-patent-ruling-1.15522>

3 [http://www.hc-sc.gc.ca/sr-sr/pubs/biotech/reg\\_gen\\_mod-eng.php](http://www.hc-sc.gc.ca/sr-sr/pubs/biotech/reg_gen_mod-eng.php)

4 John Davison (2010) "GM plants: Science, politics and EC regulations" *Plant Science* 178(2):94-98

5 [http://www.cell.com/trends/biotechnology/abstract/S0167-7799\(03\)00227-0?\\_returnURL=http%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS0167779903002270%3Fshowall%3Dtrue](http://www.cell.com/trends/biotechnology/abstract/S0167-7799(03)00227-0?_returnURL=http%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS0167779903002270%3Fshowall%3Dtrue)

6 [http://www.aaas.org/sites/default/files/AAAS\\_GM\\_statement.pdf](http://www.aaas.org/sites/default/files/AAAS_GM_statement.pdf)

7 <http://www.genetics.org/content/188/1/11.long>

out in the public sphere is based on misunderstandings of evidence and poor argumentation. That is NOT to say that there is not a good debate to be had on this topic, merely that the arguments successful teams (particularly Con team) use may not reflect the arguments you are most likely to hear on the news.

The first thing to be aware of on this topic is that the scientific evidence is fairly strongly skewed in favor of the Pro - at least with regards to GMO foods and safe human consumption. Exhaustive peer-reviewed scientific research has found no significant evidence that GMO foods cause health risks to humans<sup>8</sup>. Much like debates on climate change, it is possible to find dissenting studies, but those studies are often poorly done and vastly outweighed by the sheer quantity and quality of research that concludes that GMO foods are not dangerous to consume.<sup>9</sup> However, despite this scientific consensus, there is widespread belief among the general US population that GMO foods are potentially dangerous to consume.<sup>10</sup> This perception means that Pro teams may have more of a persuasive challenge on their hands than one would expect given how much their claims are supported by the evidence.

Part of what this evidence skew means is that the best Con ground is unlikely to be linked to arguments that “franken-foods are going to poison us all.” Rather the Con is likely to find the most fertile ground when it examines the effects that proliferation of GMO foods have had on agricultural practices. The apparent success of many GMOs has encouraged farming practices that have massively negative effects in the long term, and being able to tie GMOs to those effects will likely

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<sup>8</sup> <http://www.geneticliteracyproject.org/wp/wp-content/uploads/2013/10/Nicolia-20131.pdf>

<sup>9</sup> A.M. Mannion and Stephen Morse. "Biotechnology in agriculture: Agronomic and environmental considerations and reflections based on 15 years of GM crops."

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<sup>10</sup> [http://www.nytimes.com/2013/07/28/science/strong-support-for-labeling-modified-foods.html?\\_r=1&](http://www.nytimes.com/2013/07/28/science/strong-support-for-labeling-modified-foods.html?_r=1&)

be a core part of most successful Con strategies. If the Pro team can successfully argue that we should consider the harms and benefits of GMO foods “in a vacuum” (without considering how they are used) then this will likely be a very difficult debate for the Con. The Con, on the other hand, will likely push for us to consider GMO foods in the context of the world we live in - including what practices their existence encourages or discourages. Given the wording of the resolution “benefits ... outweigh the harms” it seems most likely we should evaluate this resolution in the present tense, as things are happening now, not in some hypothetical world where we remove the context in which GMO foods exist.

### **Potential Arguments**

This section includes a brief overview of several arguments each side could make on this topic. This is by no means an exhaustive list. Debaters are highly encouraged to create their own arguments and/or develop more nuanced versions of these arguments. This section is mainly intended to give debaters a starting point and an idea of some of the arguments they should be prepared to confront.

### **PRO**

Pro arguments on this topic are likely to fall into three major categories: GMOs increase the quantity of food produced, GMOs increase the quality of food produced, and GMOs decrease the use of harmful agricultural chemicals.

In terms of food quantity, there can be little doubt that GMOs have the potential to massively increase our ability to grow food. Crops can be made to grow more quickly, become more resistance to drought or other environmental hazards, and even survive in areas they couldn't otherwise. All of

this translates to us being able to grow more food for more people more efficiently. Given the problems of famine and starvation already afflicting the world we should do everything we can to increase the amount of food available to those in need. This need is only compounded by the staggering rate at which the world population is growing. If we're having trouble feeding 7 billion people, how can we hope to cope when that number hits 10 billion (as it is expected to by 2050)?<sup>11</sup> GMO foods are our best hope of producing enough food to feed the planet, and we must embrace them.

In addition to growing more food, GMO crops can also provide better quality food. There are many parts of the world that suffer from chronic malnutrition or lack essential vitamins or minerals in their diet. GMO foods can solve this problem, as exemplified by “golden rice.”<sup>12</sup> Golden rice is a form of rice that has been “biofortified” via genetic engineering so that it includes significantly higher levels of Vitamin A - something many people in the world lack. This is only one example of how GMO crops can actually enable us to eat healthier without actually changing our diets. Additionally GMO foods have been developed in ways that enable them to stay ripe longer, decreasing food waste at supermarkets and in transport. GMO crops have the potential to not only give us more food, but better food, and whether that's helping to fight diseases or eliminate malnutrition it's unequivocally a good thing.

Finally, GMO foods are actually significantly better for the environment because they can cut down on the use of pesticides. Many of the environmental problems associated with agriculture came from the massive amounts of highly toxic pesticide that farmers needed to use to protect their crops. Now that GMO crops can include natural pesticides (such the Bt protein) far fewer gallons of

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<http://www.telegraph.co.uk/earth/agriculture/geneticmodification/9284762/People-will-starve-to-death-because-of-anti-GM-zealotry.html>

12 [http://goldenrice.org/PDFs/Opportunity\\_squandered\\_Miller\\_TIBTEC\\_2009.pdf](http://goldenrice.org/PDFs/Opportunity_squandered_Miller_TIBTEC_2009.pdf)

pesticide need to be sprayed on our crops and dumped into our groundwater. GMO foods take the best of what nature gives us and use it our advantage by transposing it to where it can do the most good. The more GMOs we use, the fewer toxic chemicals we need to spray and the better it is for everyone.

## **CON**

Con arguments are likely to be slightly more complicated than most Pro arguments, and most of them will center around the effects of GMO foods, specifically with regards to agricultural practices.

While the evidence does not suggest that there is any significant risk to human health from GMO food consumption, it is still possible that Con teams will make the “precaution” argument - saying that we still don’t know enough and that GMO foods haven’t been “proven” to be safe. This argument is common in the media discussions of this topic, but likely to be unpersuasive when examined in depth. It’s essentially impossible to prove a negative (demonstrate that there is zero chance something will happen), and thus this argument puts an unreasonable burden of proof on the Pro - one that we would be hard-pressed to accept in any other situation. Despite this, it is one of the most popular arguments on the topic, so don’t be surprised if you hear it, and be ready to counter it. Now, on to the stronger Con arguments.

GMO foods have led to massive overuse of herbicide<sup>13</sup>. Glyphosate (Roundup) used to be used judiciously and in small amounts, since farmers had to be careful not to kill their own crops with it. The proliferation of glyphosate-resistant GMO crops has lead to massive increases in the

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<sup>13</sup>  
[http://static.ewg.org/agmag/pdfs/pesticide\\_use\\_on\\_genetically\\_engineered\\_crops.pdf](http://static.ewg.org/agmag/pdfs/pesticide_use_on_genetically_engineered_crops.pdf)



spraying of this toxic chemical, since farmers can now simply drench their fields in it to kill weeds without risk of hurting their own crops. This leads to two significant and damaging effects. First glyphosate is a poison designed to kill things, and overuse risks contamination of groundwater, rivers, and lakes, as well as massive disruption of the foodchain. Second, massive use of glyphosate (facilitated by GMO foods) has led to the emergence of “superweeds” which are entirely immune to glyphosate. There are some crops (such as cotton) which are naturally resistant to glyphosate, but more vulnerable to other herbicides. Farmers have relied on being able to use glyphosate selectively with these crops, and the emergence of glyphosate-resistant weeds has crippled its effectiveness there. In short, herbicides in moderation can be fine, but the explosion of glyphosate-resistant GMOs has caused farmers to overuse this chemical, not only dumping unacceptable levels of poison into the environment, but also crippling the effectiveness of this chemical in the few places where we really need it.

GMO crops have also increased the usage of pesticides - contrary to the claims of many proponents. While Bt modified crops were initially resistant to many pests and decreased pesticide use, their widespread use has led to the emergence of pests that are resistant to Bt14. This has forced farmers to shift to even more dangerous pesticides, such as neonicotinoids - which have been linked Colony Collapse Disorder (the destruction of honeybee colonies across North America)<sup>15</sup>. Honeybees are one of the most important pollinators in North America, and the agricultural and environmental implications of their elimination are staggering. .

Perhaps the most dangerous aspect of GMO foods is the fact that they promote “monocultures.” The term monoculture refers to a large area that grows only one type of crop

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14 <http://www.npr.org/blogs/thesalt/2013/07/09/198051447/as-biotech-seed-falters-insecticide-use-surges-in-corn-belt>

15 <http://www.bulletinofinsectology.org/pdfarticles/vol67-2014-125-130lu.pdf>

(generally from a single seed-source) and does so year after year. Historically farmers would avoid growing crops such as corn in successive years as a way to prevent pest populations specific to corn from accumulating. With GMO corn available, farmers have shifted to using it year after year, doing long-term damage to the soil and making entire swaths of agriculture vulnerable<sup>16</sup>. One of the major risks of a monoculture is that an unexpected blight or disease can destroy massive swaths of crops since they're all susceptible to the same things and there's nothing to break of the spread of the disease. The more we become reliant on GMO foods the more vulnerable our food supply becomes<sup>17</sup>.

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<sup>16</sup>     ibid.

<sup>17</sup>     <http://www.sciencedaily.com/releases/2001/10/011026074943.htm>

## Resources

### General References

*Introductory FAQ on GMO foods by the World Health Organization*

[http://www.who.int/foodsafety/areas\\_work/food-technology/faq-genetically-modified-food/en/](http://www.who.int/foodsafety/areas_work/food-technology/faq-genetically-modified-food/en/)

*Article in Nature addressing several popular conceptions about GMOs -*

<http://www.nature.com/news/case-studies-a-hard-look-at-gm-crops-1.12907>

"GMOs: a solution or a problem? A debate between Mark Lynas and Colin Tudge." *Journal of International Affairs* 67.2 (2014): 131+. Expanded Academic ASAP. Web. 5 Oct. 2014.

### Pro Evidence

*Meta-study arguing that there is no evidence of harm to humans from GMOs*

Alessandro Nicolìa, Alberto Manzo, Fabio Veronesi, and Daniele Rosellini "An overview of the last 10 years of genetically engineered crop safety research."

*Critical Reviews in Biotechnology*. March 2014, Vol. 34, No. 1, Pages 77-88

<http://www.geneticliteracyproject.org/wp/wp-content/uploads/2013/10/Nicolìa-20131.pdf>

A.M. Mannion and Stephen Morse. "Biotechnology in agriculture: Agronomic and environmental considerations and reflections based on 15 years of GM crops." *Progress in Physical Geography* December 2012 vol. 36 no. 6 747-763

*Article on Benefits of "Golden Rice"*

[http://goldenrice.org/PDFs/Opportunity\\_squandered\\_Miller\\_TIBTEC\\_2009.pdf](http://goldenrice.org/PDFs/Opportunity_squandered_Miller_TIBTEC_2009.pdf)

*Examination of the harms of pesticides (implying GMO pest resistance better)*

<http://www.psr.org/environment-and-health/environmental-health-policy-institute/responses/the-health-costs-of-our-food-production-system.html>

## Con Evidence

*Article arguing that GMOs increase pesticide and herbicide usage dramatically*

[http://static.ewg.org/agmag/pdfs/pesticide\\_use\\_on\\_genetically\\_engineered\\_crops.pdf](http://static.ewg.org/agmag/pdfs/pesticide_use_on_genetically_engineered_crops.pdf)

*Article in Science discussing the rise in herbicide resistant weeds - a result of over-spraying, which is permitted by herbicide resistant GMO crops*

<http://www.sciencemag.org/content/341/6152/1329>

*Explanation of the dangers of pesticides we are being forced to use now that Glyphosate-resistant weeds have emerged*

<http://www.wired.com/2014/06/the-future-of-biotech-crops/>

And

[http://www.centerforfoodsafety.org/files/epa-24d-letter-from-70-health-scientists-2012june22\\_71807.pdf](http://www.centerforfoodsafety.org/files/epa-24d-letter-from-70-health-scientists-2012june22_71807.pdf)

*Explanation of the risks associated with developing a monoculture:*

<http://www.sciencedaily.com/releases/2001/10/011026074943.htm>



